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ABSTRACT

This document provides summaries of data from a comparison of mathematical achievement in 1965 and 1975. Subscores for whole number, fraction, and decimal totals were obtained, as well as subscores for 691 students in grade 6. Performances on the California Achievement Test were analyzed by total group and by high and low IQ subgroups. The 1975 groups scored higher than the 1965 groups on some computation skills and lower on others. Data from questionnaires suggested that a relatively stable staff with a high mean for years of elementary teaching experience (9), and lack of any major socioeconomic change may be positive influences in maintaining selected skills. (MS)

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1965-1975: Achievement and Analysis of Computation Skills Ten Years Later (Part II)

by Professor Ann D. Hungerman

Phase I of this longitudinal study of computation skills of sixth grade students replicated the study done in 1965, using Anovar and Covar to analyze the performance of 691 students on 80 items of computation in the California Arithmetic Test. Results were reported for addition, subtraction, multiplication, division, and total computation. Item analysis results indicated some trends for performance with whole numbers, fractions and decimals. (See Part I for purpose, conceptual framework, procedures, analysis and Phase I findings.)[1]

Phase II Analysis

In phase two of the analysis, subscores for whole number, fraction, and decimal totals were obtained, as well as operational subscores within each of these three categories. Performances were analyzed not only for the 1965 and 1975 total groups, but also for the low and high I.Q. subgroups of each.

[1]Part I of this research report was published in the Mathematics Education Information Report, "Research Sections National Council of Teachers of Mathematics 55th Annual Meeting, Cincinnati, Ohio, April 20-23, 1977." ERIC-SMEAC: Ohio State University, Columbus, Ohio, December 1976.

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The mean I.Q. for both 1965 and 1975 groups was 106; therefore, that score was used to discriminate intelligence subgroups as higher or lower. Multivariate (profile) analysis was employed in order to determine whether analysis of related variables in combinations would more accurately describe the results than the original analysis of isolated variables. Frequency distribution histograms were obtained to determine a more precise description of the skill differences among the various student groups. Finally, an informal survey of teachers and principals was conducted to determine their perceptions of which factors were possible influences upon the two major findings of Phase I analysis: The 1975 group's increase in division skills and decrease in fraction skills.

Socioeconomic Information

Constraints of time and the sensitivity of current climate concerning privacy of records precluded a comparison of socioeconomic level using the occupation of the family's main wage-earner (the 1965 criterion of socioeconomic level). Interviews with personnel employed in offices or agencies which could conceivably have had some comparative socioeconomic data on file proved unsuccessful. Census data were too dated to be meaningful and the ten elementary schools in this study did not comprise the total group of district schools, compounding the problem. Two facts which can be stated are that the total enrollment at the elementary level has declined about 10%,

while the ADC total has risen. These are not simple mathematical issues, however, so no ratio conclusions can be drawn.

Most administrators expressed the opinion that the ten schools in the study represented the total range of socio-economic levels in the district and were quite stable during the decade, 1965-1975. What few evident changes there were occurred in other elementary schools which they named and which were not in the study.

Teacher Data

An informal and voluntary questionnaire was given to the 21 teachers whose classes were included in the testing; 18 were returned. Years of elementary teaching experience ranged from 2 to 17 years with a mean of 9 years. Eight of the 18 reported experience teaching SMSG from 1 to 4 years with a mean of 2.5 years. Five of the 18 had participated in earlier years of this testing project between 1965 and 1968. (Teachers received no more than two weeks' notice that testing was approved again for 1975.) Data available for the 1965 teacher group, except for their names and schools, were limited. By inference from the researcher's notes and from the 1975 data however, the mean years of teaching experience was less in 1965. The in-service training for SMSG for those who participated in SMSG during the 1960's has no parallel in 1975.

Textbooks and Individualizing

In 1965, the original year of the study, the SMSG series had been in use for three years in the schools tested. Addison-Wesley was adopted for the 1965-68 period, and in the intervening years the trend has been toward increasing use of multiple texts. In 1975, four series had been identified as "basic texts" and all schools were encouraged to use all four of them. It was reported that no school uses only one text. "Mathematics Prescription Resource Document," a continuous progress format for mathematics education, K-12, is based upon those four textbook series and was developed by a 1971 project team, revised in 1972 by a summer team, and again in 1974 by the six-member Individualized Mathematics Study Committee, with the director of mathematics education as facilitator. The stated philosophy is "to teach each child in such a way as to allow him to succeed at his own rate."

In the questionnaire, teachers reported a clear preference for both the Addison-Wesley and the Houghton-Mifflin series, with these two receiving more frequent use than Harcourt Brace or American Book Company. Three teachers use Addison-Wesley exclusively, and 13 use it often. Houghton-Mifflin is used often by 12 teachers. The reality of multiple text use was reported by six teachers who use all four texts, four teachers who use three of the four texts, and the eight remaining teachers who use two of the four texts.

When presented with a variety of ways to meet individual differences, and asked to check any which they were actually using in their classrooms, 16 checked "continuous progress" (for 1-5 years); 3 checked informal ways as well as continuous progress; 2 checked that they meet individual differences without individualizing; and 1 failed to check any of the above. When questioned about grouping across classrooms, 16 responded that their students remain in their own rooms for mathematics, and two indicated but did not explain why/how some students went to another classroom for mathematics.

The role of CAI, computer-assisted instruction, as a supplement to regular classroom instruction is not entirely clear. Two schools employed it extensively, while eight used it very little or not at all. Student experience with CAI was reported as averaging three years per student in the one school, and three and one-half years per student in the other, with every student except one reporting such experience much of which was during later elementary grades. For the remaining eight schools, the students did not even understand the question until explained, when a few mentioned having had it in the primary grades, usually for no more than one year.* No teacher or principal mentioned it as a possible influence in 1975 results.

*Only 32 of 294 students reported such experience, with 18 of them in one school (for one year) and 14 distributed in the remaining seven schools.

Phase II Findings

All differences reported below are statistically significant; few are large.

1. Both total groups and high I.Q. subgroups in 1975 scored significantly higher than the 1965 counterparts in whole number subtraction, multiplication, and total, and in decimal division. The 1975 total group, but not the 1975 high I.Q. subgroup scored higher than the 1965 counterparts in whole number division. Both total and high I.Q. 1975 groups scored significantly lower than the 1965 counterparts in fraction addition, subtraction, multiplication and total, and in decimal addition, subtraction and total. (See Table 1 and Table 3.)

2. The 1965 and 1975 low I.Q. subgroups were not significantly different in any of five whole number scores, in three of five fraction scores and in three of five decimal scores. The 1965 low I.Q. subgroup scored significantly higher than the 1975 low I.Q. subgroup in fraction addition and total, and in decimal addition. The 1975 low I.Q. subgroup scored significantly higher than the 1965 low I.Q. subgroup only in decimal division. (See Table 2.)

3. Multivariate (profile) analysis generally confirmed the results obtained in phase one analysis employing Anovar and Covar. Division differences were the only ones to vary in statistical significance. They were not significant (.07) employing Anovar, but significant (1975 > 1965, .04) employing

total I.Q. as covariate. Employing profile analysis, differences were not significant for a combination of whole number, fraction and decimal division. This was true for all comparisons: total group, low and high I.Q. subgroups. (See Tables 1-4.)

4. The 1965 and 1975 low I.Q. subgroups demonstrated parallel profiles for 13 of 18 combinations of variables, in contrast to the 1965 and 1975 high I.Q. subgroups whose profiles were parallel for only 6 of the 18 combinations. The 1965 and 1975 total groups demonstrated parallel profiles for only 3 of 18 combinations of variables. (See Table 5.)

5. Frequency distribution histograms for division scores revealed that the 1975 total group and high I.Q. subgroup compared to the 1965 counterparts, had fewer students in the lower two thirds of the distribution scale and more students in the top third for whole number division, decimal division, and total division. The 1975 total and high I.Q. groups had more students than the 1965 counterparts in the top third, but also more students than 1965 groups in the lowest third for fraction division. (See Table 6.)

The 1975 lower I.Q. subgroup had fewer students than the 1965 counterpart in the lower two thirds of the distribution scale and more in the top third only for decimal division. The 1975 low I.Q. subgroup had more students than 1965 counterparts in the top third of the distribution scale, but also more in

the lowest third for fraction division and for total division. They also had more in the top third of the distribution scale, but the same percentage in the lowest third for whole number division. (See Table 6.)

6. Frequency distribution histograms for fraction and decimal total scores revealed that the 1975 groups had fewer students in the top third of the distribution scale, and more students in the lowest third than 1965 groups. This was true for all three comparisons: total groups, low and high I.Q. subgroups, and for both fraction and decimal total scores. (See Table 6.)

7. Descriptive measures revealed no changes in minimum and maximum scores worth noting. Standard deviations with few exceptions were smaller in 1975 than in 1965 regardless of which groups were compared, total, low or high I.Q.

8. Computer programs for profile analysis and frequency distribution histograms produced a spatial arrangement of data which facilitated immediate visual perception of performance patterns. These programs were found to have definite limitations, however, as tools for comparing visually the performance patterns of different groups.

9. "Amount of time spent on the topic," was the possible influence checked most frequently by teachers for both the

division skill increase and the fraction skill decrease by the 1975 group. Principals ranked it highest as an influence upon fraction skill decrease and third, behind "teacher background, math knowledge and training," and "use of the Continuous Progress Plan," as an influence upon division skill increase. "Teacher background, math knowledge and training," was the second most frequently checked influence upon fraction skill decrease by both teachers and principals. "State Assessment, Minimal Performance Objectives, and the local system's model for instructional planning" ranked lowest by both teachers and principals as influences upon both division and fraction results. Computer assisted instruction was never mentioned. (See Table 7.)

Phase II Conclusions

1. To say that computation skills in this southeastern Michigan school district have been maintained would be misleading, although the mean for total computation did not change significantly. More accurately, one should say that improvement in some computation skills was accompanied by deterioration in others.

2. A relatively stable staff with a high mean for years of elementary teaching experience (9) may be recognized as one of the positive influences in the reported maintenance selected computational skills.

3. The lack of any major socioeconomic change, evident or documented, can also be interpreted as a positive factor in maintenance of selected computational skills.

4. Whatever influence teachers, textbooks and methods exerted appeared more effective with high I.Q. subgroup students, since low I.Q. subgroup students differed very little from 1965 to 1975.

5. The phase two expanded research design (including multivariate analysis and histograms) improved the accuracy and the scope of the description of group differences in achievement of computation skills. Removing some of the technical limitations inherent in existing computer programs for these analyses can further increase their value as research tools.

TABLE 1

SUMMARY OF MEAN DIFFERENCES IN SELECTED VARIABLES OF COMPUTATION FOR GROUP 1-1965 AND GROUP 3-1975*

TWO SAMPLE T-TESTS					MULTIVARIATE (PROFILE) ANALYSIS		
Variable	Group	Mean	Difference	Significance	Variables	Significance	Hypotheses
WNADD (7 items)	1	6.4033		.2272 (NS)	WN ADD,SUB,MULT,DIV		
	3	6.4870	.0837			.1542	Profiles are parallel.
						.0000	Variable means differ sig.
WNSUB (7 items)	1	5.7803		.0080 (3>1)		.0054	Group 3 > Group 1.
	3	6.0363	.256		WN SUB,DIV		
WNMULT (9 items)	1	6.4033		.0229 (3>1)		.5574	Profiles are parallel.
	3	6.7565	.3532			.0000	Variable means differ sig.
						.0071	Group 3 > Group 1.
WNDIV (10 items)	1	6.3508		.0369 (3>1)			
	3	6.6969	.3461				
WNTOT (33 items)	1	24.938		.0054 (3>1)			
	3	25.977	1.039				
FRADD (7 items)	1	4.2033		.0029 (1>3)	FR ADD,SUB,MULT,DIV		
	3	3.6891	.5142			.0078	Profiles are not parallel.
						.0000	Variable means differ sig.
FRSUB (7 items)	1	3.9738		.0135 (1>3)		.0026	Group 1 > Group 3.
	3	3.6114	.3624		FR MULT,DIV		
FRMULT (8 items)	1	2.8033		.0004 (1>3)		.0013	Profiles are not parallel.
	3	2.2668	.5365			.9369	Variable means do not differ sig.
						.0193	Group 1 > Group 3.
FRDIV (8 items)	1	2.5443		.6618 (NS)	FR SUB,DIV		
	3	2.4819	.0624			.0487	Profiles are not parallel.
FRTOT (30 items)	1	13.525		.0026 (1>3)		.0000	Variable means differ sig.
	3	12.049	1.476			.0845	Groups do not differ sig.
DECADD (2 items)	1	.69180		.0000 (1>3)	WNTOT, FRTOT, DECTOT		
	3	.41192	.27988			.0000	Profiles are not parallel.
						0.	Variable means differ sig.
DECSUB (2 items)	1	.61311		.0000 (1>3)		.3817	Groups do not differ sig.
	3	.36258	.25053				
DECMULT (2 items)	1	.71475		.8298 (NS)	WNDIV, FRDIV, DECDIV		
	3	.70466	.01009			.0339	Profiles are not parallel.
						0.	Variable means differ sig.
DECDIV (2 items)	1	.51803		.0000 (3>1)		.0731	Groups do not differ sig.
	3	.73834	.22031				
DECTOT (8 items)	1	2.5377		.0149 (1>3)			
	3	2.2202	.3175				

*Group 1-1965 N = 305. Group 3-1975 N = 386.

TABLE 2

SUMMARY OF MEAN DIFFERENCES FOR SELECTED VARIABLES OF COMPUTATION FOR GROUP 1-1965 LOW I.Q. AND GROUP 3-1975 LOW I.Q.*

TWO SAMPLE T-TESTS					MULTIVARIATE (PROFILE) ANALYSIS		
Variable	Group	Mean	Difference	Significance	Variables	Significance	Hypotheses
WNADD	1 Low IQ	6.2925		.9186 (NS)	WN ADD,SUB,MULT,DIV		
(7 items)	3 Low IQ	6.2805	.0120			.7032	Profiles are parallel.
						.0000	Variable means differ sig.
WNSUB	1 Low IQ	5.4694		.3528 (NS)		.5332	Groups do not differ sig.
(7 items)	3 Low IQ	5.6159	.1465				
					WN SUB,DIV		
WNMULT	1 Low IQ	5.8095		.8995 (NS)		.8397	Profiles are parallel.
(9 items)	3 Low IQ	5.8415	.032			.7335	Variable means do not differ sig.
						.3120	Groups do not differ sig.
WNDIV	1 Low IQ	5.4014		.4337 (NS)			
(10 items)	3 Low IQ	5.5976	.1962				
WNTOT	1 Low IQ	22.973		.5332 (NS)			
(33 items)	3 Low IQ	23.335	.362				
FRADD	1 Low IQ	3.2177		.0051 (1>3)	FR ADD,SUB,MULT,DIV		
(7 items)	3 Low IQ	2.5610	.6567			.1399	Profiles are parallel.
						.0000	Variable means differ sig.
FRSUB	1 Low IQ	3.0272		.2694 (NS)		.0127	Group 1 > Group 3
(7 items)	3 Low IQ	2.8110	.2162				
					FR MULT,DIV		
FRMULT	1 Low IQ	1.9932		.0533 (NS)		.5233	Profiles are parallel
(8 items)	3 Low IQ	1.6402	.353			.4598	Variable means differ sig.
						.0406	Group 1 > Group 3
FRDIV	1 Low IQ	2.0000		.1864 (NS)			
(8 items)	3 Low IQ	1.7805	.2195		FR SUB,DIV		
						.9872	Profiles are parallel
FRTOT	1 Low IQ	10.238		.0127 (1>3)		.0000	Variable means differ sig.
(30 items)	3 Low IQ	8.7927	1.4453			.1472	Groups do not differ sig.
DECADD	1 Low IQ	.46259		.0299 (1>3)	WNTOT, FRTOT, DECTOT		
(2 items)	3 Low IQ	.31098	.15161			.0032	Profiles are parallel.
						0.	Variable means differ sig.
DECSUB	1 Low IQ	.44898		.0811 (NS)		.2688	Groups do not differ sig.
(2 items)	3 Low IQ	.33537	.11361				
DECMULT	1 Low IQ	.63946		.5858 (NS)	WNDIV, FRDIV, DECDIV		
(2 items)	3 Low IQ	.60366	.0358			.0550	Profiles are parallel.
						0.	Variable means differ sig.
DECDIV	1 Low IQ	.43537		.0259 (3>1)		.6909	Groups do not differ sig.
(2 items)	3 Low IQ	.60366	.16829				
DECTOT	1 Low IQ	1.9864		.4102 (NS)			
(8 items)	3 Low IQ	1.8537	.1327				

*Low IQ means lower than 106, the total group mean in 1965 and in 1975.
Group 1-1965 Low IQ N=147. Group 3-1975 Low IQ N=164.

TABLE 3

SUMMARY OF MEAN DIFFERENCES FOR SELECTED VARIABLES OF COMPUTATION FOR GROUP 1-1965 HIGH I.Q. AND GROUP 3-1975 HIGH I.Q.*

TWO SAMPLE T-TESTS					MULTIVARIATE (PROFILE) ANALYSIS		
Variable	Group	Mean	Difference	Significance	Variables	Significance	Hypotheses
WNADD	1 High IQ	6.5063		.0915 (NS)	WN ADD,SUB,MULT,DIV		
(7 items)	3 High IQ	6.6396	.1333			.1638	Profiles are parallel.
						.0000	Variable means differ sig.
WNSUB	1 High IQ	6.0696		.0116 (3>1)		.0026	Group 3 > Group 1
(7 items)	3 High IQ	6.3468	.2772				
WNMULT	1 High IQ	6.9557		.0040 (3>1)	WN SUB,DIV		
(9 items)	3 High IQ	7.4324	.4767			.9891	Profiles are parallel.
						.0000	Variable means differ sig.
WNDIV	1 High IQ	7.2342		.1252 (NS)		.0214	Group 3 > Group 1.
(10 items)	3 High IQ	7.5090	.2748				
WNTOT	1 High IQ	26.766		.0026 (3>1)			
(33 items)	3 High IQ	27.928	1.162				
FRADD	1 High IQ	5.1203		.0045 (1>3)	FR ADD,SUB,MULT,DIV		
(7 items)	3 High IQ	4.5225	.5978			.0021	Profiles are not parallel.
						.0000	Variable means differ sig.
FRSUB	1 High IQ	4.8544		.0004 (1>3)		.0008	Group 1 > Group 3.
(7 items)	3 High IQ	4.2027	.6517				
					FR MULT, DIV		
FRMULT	1 High IQ	3.5570		.0001 (1>3)		.0002	Profiles are not parallel.
(8 items)	3 High IQ	2.7297	.8273			.6043	Variable means do not differ sig.
						.0182	Group 1 > Group 3
FRDIV	1 High IQ	3.0506		.8074 (NS)			
(8 items)	3 High IQ	3.0000	.0506		FR SUB,DIV		
						.0062	Profiles are not parallel.
FRTOT	1 High IQ	16.582		.0008 (1>3)		.0000	Variable means differ sig.
(30 items)	3 High IQ	14.455	2.127			.0309	Group 1 > Group 3.
DECADD	1 High IQ	.90506		.0000 (1>3)	WNTOT, FRTOT, DECTOT		
(2 items)	3 High IQ	.48649	.41857			.0000	Profiles are not parallel.
						0.	Variable means differ sig.
DECSUB	1 High IQ	.76582		.0000 (1>3)		.1422	Groups do not differ sig.
(2 items)	3 High IQ	.38739	.37843				
					WNDIV, FRDIV, DECDIV		
DECMULT	1 High IQ	.78481		.9330 (NS)		.2645	Profiles are parallel.
(2 items)	3 High IQ	.77928	.00553			0.	Variable means differ sig.
						.1842	Groups do not differ sig.
DECDIV	1 High IQ	.59494		.0007 (3>1)			
(2 items)	3 High IQ	.83784	.24290				
DECTOT	1 High IQ	3.0508		.0032 (1>3)			
(8 items)	3 High IQ	2.4910	.5598				

*High IQ means 106 or higher (106 was the total group mean in 1965 and in 1975).

Group 1-1965 High IQ N=158. Group 3-1975 High IQ N=222

TABLE 4

SUMMARY OF PROFILE ANALYSIS: HYPOTHESIS 3,
STRATA (GROUP) DIFFERENCES

Profile Variables	Group 1-1965	Group 3-1975	Low I.Q. 1965	Low I.Q. 1975	High I.Q. 1965	High I.Q. 1975
A,S,M,D	NS		NS		NS	
A,M	NS		NS		1 > 3	.02
S,D	NS		NS		NS	
WN-A,S,M,D	3 > 1	.0054	NS		3 > 1	.0026
WN-S,D	3 > 1	.0071	NS		3 > 1	.0214
FR-A,S,M,D	1 > 3	.0026	1 > 3	.0127	1 > 3	.0008
FR-S,D	NS		NS		1 > 3	.0309
FR-M,D	1 > 3	.0193	1 > 3	.0406	1 > 3	.0182
TOTALS-WN,FR,DEC	NS		NS		NS	
TOTALS-FR,DEC	1 > 3	.0019	1 > 3	.0176	1 > 3	.0005
TOTALS-WN,FR	NS		NS		NS	
TOTALS-WN,DEC	NS		NS		NS	
DIV-WN,FR,DEC	NS		NS		NS	
DIV-WN,FR	NS		NS		NS	
DIV-WN,DEC	3 > 1	.0027	NS		3 > 1	.0139
DIV-FR,DEC	NS		NS		NS	
MONEY-A,DEC-A	1 > 3	.0071	NS		1 > 3	.0002
MONEY-S,DEC-S	1 > 3	.0013	NS		1 > 3	.0009
H-3	1 > 3 in 5 of the 18 combinations of related variables. 3 > 1 in 3 of the 18 variable combinations.		1 Low I.Q. > 3 Low I.Q. in 3 of the 18 combinations of related variables. 3 Low I.Q. > 1 Low I.Q. in none.		1 High I.Q. > 3 High I.Q. in 7 of the 18 combinations of related variables. 3 High I.Q. > 1 High I.Q. in 3 of the 18 variable combinations.	

TABLE 5

SUMMARY OF PROFILE ANALYSIS: HYPOTHESIS 1, PARALLELISM OF PROFILES, AND HYPOTHESIS 2, EQUALITY OF VARIABLE MEANS

H-1 PARALLELISM

Profile Variables	Group 1-1965	Group 3-1975	Low I.Q. 1965	Low I.Q. 1975	High I.Q. 1965	High I.Q. 1975
A,S,M,D	———		Parallel		———	
A,M	———		Parallel		———	
S,D	———		Parallel		———	
WN-A,S,M,D	Parallel		Parallel		Parallel	
WN-S,D	Parallel		Parallel		Parallel	
FR-A,S,M,D	———		Parallel		———	
FR-S,D	———		Parallel		———	
FR-M,D	———		Parallel		———	
TOTALS-WN,FR,DEC	———		Parallel		———	
TOTALS-FR,DEC	———		———		———	
TOTALS-WN,FR	———		———		———	
TOTALS-WN,DEC	———		Parallel		———	
DIV-WN,FR,DEC	———		Parallel		Parallel	
DIV-WN,FR	———		———		Parallel	
DIV-WN,DEC	Parallel		Parallel		Parallel	
DIV-FR,DEC	———		———		Parallel	
MONEY-A,DEC-A	———		———		———	
MONEY-S,DEC-S	———		Parallel		———	
H-1 Summary	Groups 1-1965 and 3-1975 demonstrated parallel profiles for 3 of 18 combinations of related variables.		The low I.Q. subgroups in 1965 and 1975 demonstrated parallel profiles for 13 of 18 combinations of related variables.		The high I.Q. subgroups in 1965 and 1975 demonstrated parallel profiles for 6 of 18 combinations of related variables.	
H-2 EQUALITY OF VARIABLE MEANS						
FR-M,D	Not sig. diff.		Not sig. diff.		Not sig. diff.	
WN-S,D	———		Not sig. diff.		———	
H-2 Summary	With the exception of the four cases cited above, means for variables combined in each profile were significantly different from each other in all paired comparisons. EXCEPTIONS: The means for multiplication and division of fractions were <u>not</u> significantly different from each other in paired comparisons of total, low I.Q. or high I.Q. groups. The means for whole number subtraction and division were not significantly different from each other in the <u>low</u> I.Q. subgroup comparison only.					

TABLE 6

FREQUENCY DISTRIBUTIONS IN SELECTED VARIABLES OF COMPUTATION FOR GROUP 1-1965, GROUP 3-1975, AND THE LOW I.Q. AND HIGH I.Q. SUBGROUPS OF EACH

Variable	Interval Midpoints*	FREQUENCY DISTRIBUTION %					
		Gp. 1 1965	Gp. 3 1975	Low I.Q. 1965	Low I.Q. 1975	High I.Q. 1965	High I.Q. 1975
Fraction	0-3-6-9	39.1	47.3 +	59.3	72.0 +	20.2	29.3 +
Total	12-15-18	41.0	39.6 -	35.4	25.0 -	46.2	50.5 +
(30 items)	21-24-27-30	20.1	13.0 -	5.5	3.0 -	33.6	20.4 -
Decimal	0-1-2	54.4	60.8 +	63.9	69.5 +	45.6	54.6 +
Total	3-4-5	38.6	33.9 -	34.7	30.0 -	42.4	37.0 -
(8 items)	6-7-8	7.0	5.2 -	1.4	.6 -	12.1	8.6 -
Division	0-2-4-6	19.6	18.7 -	30.0	33.6 +	10.1	7.7 -
Total	8-10-12	61.2	55.5 -	66.0	54.0 -	57.0	55.4 -
(20 items)	14-16-18-20	19.0	26.0 +	4.1	11.0 +	33.0	37.1 +
WN	0-1-2-3	9.1	7.7 -	15.7	15.8 S	3.1	1.8 -
Division	4-5-6	39.4	32.4 -	51.7	45.1 -	27.9	23.0 -
(10 items)	7-8-9-10	51.4	59.8 +	32.6	39.0 +	69.1	75.2 +
FR	0-1-2	54.7	56.0 +	68.7	72.0 +	41.8	44.2 +
Division	3-4-5	38.1	35.3 -	30.6	25.7 -	44.9	42.3 -
(8 items)	6-7-8	7.2	8.8 +	.7	2.4 +	13.3	13.6 +
DEC	0	53.4	43.5 -	60.5	54.3 -	46.8	35.6 -
Division	1	41.3	39.1 -	35.4	31.1 -	46.8	45.0 -
(2 items)	2	5.2	17.4 +	4.1	14.6 +	6.3	19.4 +

*Intervals were grouped to approximate "thirds" of the distribution. The number indicates the percentage of students scoring within that partial range of the continuum, the desirable pattern is $\left(\frac{-}{+}\right)$, indicating fewer students in the lowest range and middle range and more students in the top range. Less desirable is $\left(\frac{+}{+}\right)$ indicating more students in the higher range, but also more in the lowest range.

TABLE 7

SURVEY OF TEACHER AND PRINCIPAL PERCEPTION OF POSSIBLE FACTORS AFFECTING DIVISION SKILL INCREASE AND FRACTION SKILL DECREASE, 1965-1975

N of times factor was checked as an influence upon:	DIVISION Skill Increase	FRACTION Skill Decrease
TEACHERS (N=13)		
Amount of time spent on topic	11	9
Use of Continuous Progress Plan	8	4
Use of multi-texts	7	1
Teacher background, math knowledge, training	6	6
Textbook approach	3	1
XMIP - Local System Model for Instructional Planning	1	-
Michigan (SDE) Assessment	1	-
MPO's - Michigan Minimal Performance Objectives	-	-
PRINCIPALS (N=9)		
Amount of time spent on topic	4	7
Use of Continuous Progress Plan	7	1
Teacher background, math knowledge, training	6	3
Textbook approach	3	2
Use of multi-text	3	1 ("misuse")
Michigan (SDE) Assessment	3	1
MPO's - Michigan Minimal Performance Objectives	3	1
XMIP - Local System Model for Instructional Planning	2	1